Chocolate chip cookie recipe:

makes 4 dozen.

4 c. flour
2 eggs
2 c. butter
2 tsp. vanilla
2 tsp. baking powder
1 c. milk
1 tsp. salt
2 bags chocolate chips

I only have 2/3 bag of chocolate chips. What do I do? How does this affect my cookie-making?

I don't have enough chips to make 4 dozen cookies. So, it's my limiting ingredient. It will control how many cookies I can make.

Original Recipe

4 c. flour
2 eggs
2 c. butter
2 tsp. vanilla
2 tsp. baking powder
1 c. milk
1 tsp. salt
2 bags chocolate chips

So, how do I modify this recipe for 2/3 bag of chips?

How much flour do I need?

$$0.667 \text{ bag} \times \frac{4 \text{ c. flour}}{2 \text{ bags}} = 1.33 \text{ c. flour}$$

How much butter do I need?

$$0.667 \text{ bag} \times \frac{2 \text{ c. butter}}{2 \text{ bags}} = 0.667 \text{ c. butter}$$

How to modify a recipe: Find your limiting ingredient. Multiply the given amount of that ingredient by a ratio of the needed ingredient over the given ingredient from the original recipe.

Most of the time we'll work in grams, so we must convert to moles:

$2Cu\ (s) + S\ (s) \rightarrow Cu_2S\ (s)$

What is the limiting reagent when 80.0g Cu reacts with 25.0g S?

$$80.0\text{g Cu} \times \frac{1\text{ mol Cu}}{63.5\text{ g}} = 1.26\text{ mol Cu}$$

Given quantity

$$25.0\text{g S} \times \frac{1\text{ mol S}}{32.1\text{ g}} = 0.779\text{ mol S}$$

Given quantity

Given quantity → Needed quantity

$$1.26\text{ mol Cu} \times \frac{1\text{ mol S}}{2\text{ mol Cu}} = 0.630\text{ mol S}$$

S is in excess and is excess reagent. Cu is limiting reagent.

$Mg + 2HCl \rightarrow MgCl_2 + H_2$

Identify the limiting reagent when 6.00g HCl reacts with 5.00g Mg.

1. Convert given quantities to moles:

$$6.00\text{g HCl} \times \frac{1\text{ mol}}{36.5\text{g}} = 0.164\text{ mol HCl}$$ ← given

$$5.00\text{g Mg} \times \frac{1\text{ mol}}{24.3\text{g}} = 0.206\text{ mol Mg}$$ ← given

2. Use mole ratios to find needed quantities:

$$0.164\text{ mol HCl} \times \frac{1\text{ mol Mg}}{2\text{ mol HCl}} = 0.082\text{ mol Mg}$$

↑ needed

HCl is limiting reagent.

Analyze:

Given:	Needed:
0.164 mol HCl	
0.206 mol Mg	0.082 mol Mg

We have more Mg than is needed, so Mg is in excess. Mg is the excess reagent. Therefore, HCl is the limiting reagent.

$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

How many grams of water can be produced by the reaction of 2.40 mol C_2H_2 with 7.40 mol O_2?

First, identify the limiting reagent:

$$2.40 \text{ mol } C_2H_2 \times \frac{5 \text{ mol } O_2}{2 \text{ mol } C_2H_2} = 6.00 \text{ mol } O_2$$

$$\underset{\text{given}}{7.40 \text{ mol } O_2} \times \frac{2 \text{ mol } C_2H_2}{5 \text{ mol } O_2} = \underset{\text{needed}}{2.96 \text{ mol } C_2H_2}$$

C_2H_2 is limiting reagent.

C_2H_2 is limiting reagent, so use that to find grams of water produced.

$$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$$

$$2.40 \text{ mol } C_2H_2 \times \frac{2 \text{ mol } H_2O}{2 \text{ mol } C_2H_2} \times \frac{18.0 \text{g}}{1 \text{ mol}} = 43.2 \text{g } H_2O$$

Now, complete #45, 46, and 47 on p. 379, and show your answers to the teacher. When you get all answers correct, proceed to the next page.

Do your work here:

45. the limiting reagent controls the maximum amount of product produced. The excess reagent is only partially consumed in the reaction.

46. Convert given reactants to moles, multiply by correct mole ratio, compare needed reactants to given reactants.

47. $2Al + 3Cl_2 \rightarrow 2AlCl_3$

a. Given: 3.0 mol Al, 5.3 mol Cl_2

Find limiting and excess reagents:

$$3.0 \text{ mol Al (given)} \times \frac{3 \text{ mol } Cl_2}{2 \text{ mol Al}} = 4.5 \text{ mol } Cl_2 \text{ (needed)}$$

b. $$3.0 \text{ mol Al} \times \frac{2 \text{ mol } AlCl_3}{2 \text{ mol Al}} = 3 \text{ mol } AlCl_3$$

c. $5.3 - 4.5 = 0.8$ mol Cl_2

In groups of 2 or 3, work on the 12 multiple choice questions attached to the end of this packet. When your group finishes, take your papers up to the teacher to be corrected. You may correct your work and continue working up until 10 minutes before the end of the period. At that point, your paper must be graded by the teacher.